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Comorbidity and Delayed to Seek Medical Treatment as Risk Factors of Severe Pneumonia in Children at Sanglah General Hospital

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Abstract: ***Background Childhood pneumonia remains a leading killer of children in developing countries, where it accounts for up to 21% of deaths in children under the age of five years. Severe clinical pneumonia is caused by a combination of exposure to risk factors related to the host, environment and infection. Approximately 13% of pneumonia cases are severe enough to require hospitalization. Studies on the risks factors for severe pneumonia are few in the literature and done more than a decade ago. Objective This study aims to identify risk factors of severe pneumonia in children at Sanglah General Hospital. Methods The study design is retrospective analytic case control, involving 45 childrens with severe pneumonia (case group) and 45 childrens with pneumonia (control group) who came to Sanglah General Hospital. Data was obtained from the initial medical records of pediatric patients with pneumonia and severe pneumonia in Respirology division child health department Sanglah General Hospital during period January 2015 to December 2016. Results Total of 90 subjects were included in this study and divided in to 45 subjects in case group and 45 subjects in control group. Data shows that males more than females in both groups (64.4% vs 60.0%). Most of them are in the age interval 3-60 months (75.6% vs 68.9%). Multivariate analysis showed that only having comorbidity (OR 5.4; 95% CI 1.9 to 15.0) and delay for 3 or more days to seeking treatment in health facility (OR 3.9; 95% CI 1.4 to 11.0) were significant risk factors of severe pneumonia in children. Conclusion Comorbidity and delay for 3 or more days to seeking treatment in health facility are the main risk factors for severe pneumonia.***

Keywords: risk factor, severe pneumonia, children

1. Introduction

Pneumonia is a leading cause of mortality among children under the age of five years globally, in developing countries where it accounts for up to 21% of deaths in children under the age of five years.[1,2] The incidence of pneumonia in children under the age of five years is 0.29 episodes per child-year, which equates 151.8 million cases annually in developing countries, a further 4 million cases occur in developed countries.[3] The mortality rates of children under the age of five years in most developing countries ranges from 60 to 100 per 1000 live births, one fifth of these deaths are due to pneumonia. An estimated 1.9 million children die from pneumonia yearly.[3,4] Half the world's deaths due to pneumonia in children under the age of five years occur in Africa.[5]

Fifteen countries including Indonesia contribute 74% of the world's annual pneumonia cases.[3] Based on Survei Demografi dan Kesehatan Indonesia (SDKI) declared an increase incidence of pneumonia in toddlers from 2002-2007, 7.6% to 11.2%. Bali is the second province with the highest incidence of pneumonia in Indonesia in 2007 amounted to 11.1%. Denpasar is the fourth highest coverage of pneumonia in Bali of 18.73%.[5]

Severe pneumonia in childhood is associated with increased burden of disease[6] and is more fatal than non severe disease.[7] Severe clinical pneumonia is caused by a combination of exposure to risk factors related to the host, the environment and infectious microorganisms. Several risk factors that are associated with severe pneumonia, such as has comorbidity, delayed to seek medical treatment in a health facility, contact with member of the household with upper respiratory tract infection and received antibiotics at home.[8]

Approximately 13% of pneumonia cases are severe enough to require hospitalization.[9] Of all the pneumonia cases occurring in countries with high incidence, 8.7% are severe enough to be life threatening.[2] Understanding the epidemiology of severe pneumonia has been identified as a pressing priority for public health research.[1] Studies on the risks factors for severe pneumonia are few in the literature and done more than a decade ago.[10,11] The purpose of this study is : whether the pantient with comorbid, delayed to seek medical treatment in health facility, contact with member of the household with upper tract infection and received antibiotics at home as a risk factor becomes severe pneumonia in children at Sanglah General Hospital.

2. Method

The study design is retrospective analytic case control. Both cases and controls were recruited at Sanglah General Hospital Denpasar based on patient's medical record. Case patients were children with severe pneumonia and control patients were children with pneumonia based on World Health Organization (WHO) classification and treatment of childhood pneumonia.[12]. The population target is all the pediatric patient whom diagnosed with pneumonia and severe pneumonia that being admitted at Sanglah General Hospital who seek medical treatment Sanglah General Hospital Denpasar from period January 2015 to December 2016. Patients with not complete medical record will be excluded in this study.

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Data was obtained from the initial medical records of pediatric patients with pneumonia and severe pneumonia in Respirology division, Department of Child Health Sanglah Hospital during period January 2015 to December 2016. Only the complete medical record were used as study participant. This study has been permitted from the Ethics Committee of the Udayana University Medical School.

The selection of samples used consecutive sampling method where subjects who met the study criteria selected sequentially until the required sample size was met and the medical record had complete information needed in this research. In this study, we were aiming maximum sample size and p <0.05 as a significant degree. Sample size was calculated by using the sample size estimation equation for two proportions. Proportion from each variable was calculated and the variable that gave the largest sample size was chosen.[13] Previous studies show that has comorbidity is the risk factor that gives maximum sample size.[14,15] Proportion of case (P1)= 0.56, we found minimum sample size in this study was 45 subjects for case group and 45 subjects for control group.

Descriptive data would be shown as percentage and range in table and narration. Data was analyzed using SPSS software for Windows. Bivariate analysis was performed using chi-square test or Fischer's exact test. For multivariate analysis, we performed multiple logistic regression model, to determine risk factors that significantly associated with severe pneumonia in children. The strength of association was indicated by odds ratio (OR); confidence intervals were supplied. Level of significance was set at p<0.05.

Diagnosis of pneumonia is according to WHO classification is two categories: pneumonia is cough or difficult breathing plus at least one of the fast with fast breathing and/or chest indrawing and severe pneumonia is pneumonia with any general danger sign (oxygen saturation <90% or central cyanosis, grunting, very severe chest indrawing, inability to breastfeed, lethargy or reduced level of conciousness, and convulsi).[13] Age was determined based on chronological age (date of birth) and divided into three categories (< 3 months, 3 to 60 months, and > 60 months). Comorbid disease is the presence of one or more additional diseases or disorders co-occuring with a primary disease such as HIV, malignancy, diarrhea, cholestasis, iron deficiency anemia, thalassemia, congenital heart disease, cerebral palsy, failure to thrive. Delayed to seek medical treatment in a health facility was defined as a period of more than 24 hours having passed between the onset of symptoms and treatment having sought at a clinic or public hospital and divided into two categories (< 3 days and ≥ 3 days). Contact with member of the household with upper respiratory tract infection was defined direct contact from family member with upper respiratory illness. Received antibiotics at home was defined patient who can be treated as outpatients with oral antibiotics.

3. Result

A total of 90 subjects were included in this study and divided in to 45 subjects in case group and 45 subjects in control group. Subjects were categorized in to two groups based on the clinical severity of pneumonia in children. Data shows that males more than females in both groups (64.4% vs 60.0%). Most of them are in the age interval 3-60 months (75.6% vs 68.9%), in both group cases and controls were equally none had a history of preterm birth (60.0% vs 71.1%). The characteristics of study subjects are described in **Table. 1.**

Table 1: Characteristics of subjects

Characteristic	Case **n = 45**	Control **n = 45**
Age (month), n (%)		
< 3 months	10 (22.2)	11 (24.4)
3 to 60 months	34 (75.6)	31 (68.9)
> 60 months	1 (2.2)	3 (6.7)
Sex, n (%)		
Male	29 (64.4)	27 (60.0)
Female	16 (35.6)	18 (40.0)
History of preterm birth, n (%)		
Yes	18 (40.0)	13 (28.9)
No	27 (60.0)	32 (71.1)
Maternal education level, n (%)		
Low education level	26 (57.8)	18 (40.0)
Higher education level	19 (42.2)	27 (60.0)
Family income, n (%)		
Low income	17 (37.8)	7 (15.6)
Moderate income	18 (40.0)	20 (44.4)
High income	10 (22.2)	18 (40.0)

The result of bivariate analysis in **Table 2** showed that has comorbidity (OR 5.5; 95%CI 2.2 to 13.6), delayed to seek medical treatment in a health facility (OR 5.0; 95%CI 2.0 to 12.6), contact with member of the household with upper respiratory tract infection (OR 3.3; 95% CI 1.4 to 7.8) and received antibiotics at home (OR 0.4; 95% CI 0.2 to 0.9) were risk factors of severe pneumonia in children. The result of multivariate analysis in **Table 3** showed only having comorbidity (OR 5.4; 95% CI 1.9 to 15.0) and delay for 3 or more days to seek treatment in health facility (OR 3.9; 95% CI 1.4 to 11.0) were significant risk factors of severe pneumonia in children.

Table 2: Bivariate analysis

Risk Factors	Case n = 45	Control n = 45	OR	95% CI	*P*
Has comorbidity, n (%)					
Yes	33 (73.3)	15 (33.3)	5.5	2.2 to	< 0.001
No	12 (26.7)	30 (66.7)		13.6	
Delayed to seek medical treatment in a health facility, n (%)					
≥ 3 hari	34 (75.6)	17 (37.8)	5.0	2.0 to	<0.001
< 3 hari	11 (24.4)	28 (62.2)		12.6	
Contact with member of the household with upper respiratory tract infection, n (%)					
Yes	30 (66.7)	17 (37.8)	3.3	1.4 to	0.006
No	15 (33.3)	28 (62.2)		7.8	
Received antibiotics at home, n (%)					
Yes	18 (40.0)	28 (62.2)	0.4	0.2 to	0.035
No	27 (60.0)	17 (37.8)		0.9	

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Bivariate analysis was performed using chi-square test. OR: odds ratio; CI: confidence interval; p<0.05.

Table 3: Multivariate analysis risk factors of severe pneumonia

Variable	Adjusted OR	95% CI	*P*
Having a comorbidity	5.4	1.9 to 15.0	0.001
Delay for 3 or more days to seek treatment in health facility	3.9	1.4 to 11.0	0.009
Contact with member of the household with upper respiratory tract infection	2.8	0.9 to 7.6	0.052
Received antibiotics at home	0.4	0.1 to 1.0	0.073

Multivariate analysis was performed using regression logistic test. OR: odds ratio; CI: confidence interval; p<0.05.

4. Discussion

Patient with comorbidity were four times more likely to have severe pneumonia. Children who have a concomitant chronic illness may have their immunity lowered making them more susceptible to severe disease. As for the underlying chronic diseases such as chronic lung disease of prematurity, congenital heart disease, bronchial asthma, malnutrition, and human immunodeficiency virus. Suwanjutha et al (1994) found that children with an underlying heart condition were four times more likely to have severe pneumonia.[16] Children who are human immunodeficiency virus infected are 40 times more likely to get pneumonia than not infected HIV. Furthermore, they are prone to infection by atypical organisms and antibiotic resistant strains.[13,14] Rudan et al (2008) in their metaanalysis lists the presence of concomitant diseases as one of the likely risk factors for pneumonia, most evidence consistently point to the role, but there are some opposing findings.[3] In this study, showed that patient with comorbidity were significant risk factors of severe pneumonia (OR 5.4, 95% CI 1.9 to 15.0, p 0.001).

Children who delayed to seek medical treatment in a health facility by three days or more were twice more likely to present with severe pneumonia. This finding is consistent with a study in Uganda that found the median duration of illness before care is sought to be seven days.[15] Another study in Uganda also found the long delay in seeking medical care with majority of the respondents having tried home medication before visiting the health facility. This delay was in spite of the fact that there was prompt recognition of symptoms.[17] The progress of pneumonia is rapid and delayed intervention can lead to increased disease severity and even death.[18] The possible explanation for this delay is the various pre-hospital home treatments that children get before seeking care in a health facility. The treatments given in these circumstances are often inappropriate or inadequate. These findings are consistent with a WHO report which has identified the delay in seeking care as children are treated at home through the informal sector or by traditional healers as an important barrier to the reduction of mortality in children.[19] In this study, we found that children who delayed to seek medical treatment in a health facility by three days or more was significant risk factors of severe pneumonia (OR 3.9, 95% CI 1.4 to 11.0, p 0.009).

Those who had a member of their household with upper respiratory symptoms were about three times more likely to have severe pneumonia. A study by Broor et al had similar findings that upper respiratory infection in the mother had an odds ratio of 6.53 and upper respiratory infection in siblings had the odds ratio was 24.21 Upper respiratory tract infections are very contagious and are easily transmitted from household contacts to children. These infections are often viral in origin and predispose children to pneumonia.[21] Severity of the disease also depends on virulence and load of the pathogen; the load is usually higher when infection is from a household contact.[22] In this study, we found that who had a member of their household with upper respiratory symptoms were associated with higher risk for severe pneumonia, although it was not statistically significant in the multivariate analysis (OR 2.8, 95% CI 0.9 to 7.6, p 0.052). Based on the results of research in many countries, including Indonesia and various scientific publications reported risk factors that increase the incidence of upper respiratory tract infection influenced by several factors, such as : host (human existence is influenced by: age, sex, nutritional status, low birth weight, breastfeeding status, immunization status, vitamin A), agent (factors that cause the disease include bacteria, viruses, and parasites), and environment (factors outside of the patient that will affect the existence of the host environment consists of biological, physical and social). In this study we didn't have data about factors that influence the spread of upper respiratory tract infection.[17]

Receiving antibiotics at home reduced the risk of severe pneumonia. Hildenwall et al implies that receiving antibiotics at home protects children from severe pneumonia.18 World Health Organisation recommended the treatment of non-severe pneumonia with oral antibiotics by trained medical personnel at the community level.[19] A metaanalysis of clinical trials on community case management reported a 36% decline in child mortality from pneumonia when trained community health workers administered antibiotics to children under the age of five years with pneumonia.[23] An update to the above meta analysis estimates that community case management can reduce pneumonia mortality by about 70% in children under the age of five years.[24] A recent randomized clinical trial done in rural Pakistan in which children with severe pneumonia were randomized to receive oral amoxicillin at home or cotrimoxazole and referral to a health facility showed similar levels of treatment failure in the two groups. This finding suggests that severe pneumonia can be successfully treated at the community level with oral amoxicillin in resource poor settings.[25] In spite of this overwhelming body of evidence, many developing countries including Kenya have no policy to permit and implement community case management. Kenya is estimated to have a pneumonia treatment gap of 804,000 per year in children aged under five years which can be reduced by community case management implementation.[26] In this study, we found that who had receiving antibiotics at home it was not statistically significant in the multivariate analysis (OR 0.4, 95% CI 0.1 to 1.0, p 0.073) this can be caused by most sick children were taken to qualified providers at some stage, and most of parents wait a long time to recognition symptoms before being taken to a health worker.

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5. Conclusion

Comorbidity and delay in seeking appropriate treatment are the main risk factors for severe pneumonia. We recommend more health education regarding appropriate health seeking and greater interventions at the community level by engaging trained medical personnel in pneumonia prevention, control and treatment. Weakness of these studies, among others, this study uses secondary data and small amount of sample. Further research is needed with a better design to evaluate the consistency of the results of this study.

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